Psychoneuroendocrinology 110 (2019) 104368

Contents lists available at ScienceDirect

Psychoneuroendocrinology

journal homepage: www.elsevier.com/locate/psyneuen

Father support is protective against the negative effects of perceived discrimination on CRP among sexual minorities but not heterosexuals

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ARTICLE INFO

Keywords:
Cardiovascular risk
C-reactive protein
Discrimination
Sexual orientation
Father support

ABSTRACT

Background: Exposure to sexual orientation-related discrimination among sexual minorities may lead to elevated levels of C-reactive protein (CRP) as compared to their heterosexual counterparts. However, little is known about factors that may buffer the association between discrimination and CRP among sexual minorities versus heterosexuals. The current study examined if the association between discrimination, sexual orientation, and CRP differed across levels of social support from one's father/father-figure or mother/mother-figure between sexual minorities and heterosexuals.

Methods: Data came from Wave IV of the National Longitudinal Study of Adolescent to Adult Health (Add Health). The sample sizes for father support and mother support was 3167 and 3575, respectively. Participants ranged in age from 24 to 33 years. Stratified linear regression models examined if father and mother support moderated the association between discrimination and CRP among sexual minorities and heterosexuals.

Results: Father support significantly moderated the association between discrimination and CRP among sexual minorities but not heterosexuals. Sexual minorities with higher father support and who experienced discrimination had lower CRP as compared to those with lower father support and who experienced discrimination. Mother support did not moderate the association between discrimination and CRP among either sexual minorities or heterosexuals.

Conclusion: Father support may mitigate the negative effects of stress from discrimination on CRP among sexual minorities. Future research should further examine the potential differential role that father support may play in reducing cardiovascular risk among sexual minorities versus heterosexuals who experience discrimination.

1. Introduction

1.1. Overview

Sexual minorities are more likely than their heterosexual counterparts to experience a cardiovascular event (Frost et al., 2013; Halkitis et al., 2017; Hatzenbuehler et al., 2013; Meyer, 2003). However, individual-level factors alone (e.g., tobacco use) are not enough to account for these disparities (Millett et al., 2007). Sexual minority stress (SMS) theory posits that exposure to sexual orientation-related stigma and discrimination places sexual minority individuals under an excess burden that eventually takes a toll on the biological stress system (Hatzenbuehler, 2009). These stress-reactive physiological changes may lead to the chronic production of inflammatory proteins such as C-reactive protein (CRP), thereby increasing cardiovascular risk (Hatzenbuehler et al., 2014).

Although accumulating evidence demonstrates that stress resulting from discrimination exposure is associated with various biomarkers of inflammation, including CRP levels (Cook et al., 2017; Hatzenbuehler et al., 2013; Zeiders et al., 2014), factors that influence resilience to discrimination exposure among sexual minority as compared to heterosexual populations are currently unknown. Nevertheless, it is important to explore potential factors that may influence biological stress processes to better understand and address the mechanisms underlying

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https://doi.org/10.1016/j.psyneuen.2019.06.019
Received 28 November 2018; Received in revised form 28 June 2019; Accepted 28 June 2019
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cardiovascular health disparities between sexual minority and heterosexual populations. One protective pathway may be that of parental support; however, very few studies have explored how father and mother support independently influence health outcomes among sexual minorities versus heterosexuals. Particularly underexplored is the potential protective role of father support, despite evidence suggesting that perceived support from one's father or father-figure influences health outcomes throughout the life-course (Flouri and Buchanan, 2003).

1.2. Stress exposure and biological stress/inflammatory biomarkers among sexual minority populations

Repeated exposure to stress places a strain on the biological stress system, eventually positioning individuals at a greater risk for experiencing negative health outcomes (Juster et al., 2010; McEwen, 1998). During a stress event, the hypothalamic-pituitary-adrenal (HPA) axis is activated and stimulates the secretion of stress-related hormones such as glucocorticoids and catecholamines (McEwen, 1998). Normally, the secretion of these hormones steadily decreases after the stressful event has passed. However, persistent exposure to stress may result in the chronic secretion of stress hormones, which in turn may lead to an inflammatory response (McEwen, 1998). Such responses, which include elevated CRP, may culminate into adverse cardiovascular health outcomes.

A wide research literature documents the adverse effects of chronic stress exposure on indices of cardiovascular health throughout the life-course (Hakulinen et al., 2016; Hatzenbuehler et al., 2013; Juster et al., 2010; May et al., 2012; Slopen et al., 2012; Su et al., 2015). Children exposed to poverty, abuse, or other adverse early life experiences are more likely to have elevated levels of CRP and are at an increased risk of experiencing a cardiovascular event later in life (Hakulinen et al., 2016; Slopen et al., 2012). However, sexual minority populations are exposed to a variety of psychosocial stressors, including stigma, discrimination, rejection, and internalized homophobia, known as minority stressors. Repeated exposure to minority stress places an excess burden on the biological stress system as sexual minority individuals navigate a world in which they learn to cope with minority stress alongside other forms of daily stress. In turn, sexual minority individuals may experience more pronounced stress throughout their day-to-day lives as compared to their heterosexual counterparts due to exposure to sexual minority stress (Hatzenbuehler, 2009; Meyer, 2003), which may culminate in the production of inflammatory biomarkers due to the dysregulation of the biological stress response system (Hatzenbuehler et al., 2014). Indeed, longitudinal research examining diurnal cortisol patterns found that sexual minority individuals exhibit more disrupted diurnal cortisol patterns as compared to their heterosexual counterparts (Austin et al., 2016; Cook et al., 2017), and that sexual minority individuals are more likely to have elevated CRP levels as compared to their heterosexual counterparts (Caceres et al., 2017; Hatzenbuehler et al., 2013).

1.3. Social support, stress, and sexual orientation

However, not all those exposed to minority stress will experience adverse biological stress responses. What is currently unknown are the pathways through which sexual minority individuals experience resilience in the face of risk. Cook and Calebs (2016) argue, however, that supportive social networks may mitigate against the ill effects of sexual minority stress. According to this theory, known as the integrated attachment and sexual minority stress (IASMS) model, supportive social relationships may aid in downregulating the biological stress response which may, in consequence, foster the development of healthier coping mechanisms and reduce the risk of poor health outcomes related to prolonged stress exposure. Some evidence exists in support of the IASMS. For instance, one study found that strong perceived familial support, and not peer or overall perceived social support, was associated with lower cortisol reactivity to a social stress task among sexual minority participants (Burton et al., 2014). However, there is limited research examining the impact that specific forms of parental support (e.g., father support, mother support) have on indices of cardiovascular health among sexual minority versus heterosexual populations. The existing studies tend to operate under the assumption that sexual minorities have strained relationships with their parents (Bouris et al., 2010), or focus solely on maternal social support (Needham and Austin, 2010), thus occluding the impact that paternal social support may have on health outcomes among sexual minority and heterosexual populations. This is an important area to explore, as past research suggests that heterosexual men tend to hold more negative attitudes about sexual minority identities as compared to heterosexual women (Herek, 2002; Moskowitz et al., 2016). This, in turn, may influence the level and quality of perceived support from one's father among sexual minority populations.

Therefore, in this study we sought to investigate the specific roles that father support and mother support may play in protecting against the ill effects of stress resulting from exposure to discrimination among sexual minority and heterosexual populations. Based on previous literature, we hypothesize that among both sexual minorities and heterosexuals, those who experience discrimination and who have higher perceived father or mother support will exhibit less signs of early cardiovascular risk (i.e., lower CRP levels) as compared to those who experience discrimination and who have less father or mother support. However, we hypothesize that these associations will be stronger among sexual minorities as compared to heterosexuals.

2. Method

2.1. Sample

Data came from a nationally representative study of adolescents and young adults in the United States called the National Longitudinal Study of Adolescent to Adult Health (Add Health; Resnick et al., 1997). In 1994, Add Health researchers recruited a school-based sample of adolescents from Grades 7 to 12 and followed them into young adulthood. At Wave I (1994), researchers used a systematic random sample of 80 nationally representative U.S. high schools to participate in a longitudinal study of adolescent health. Further, a feeder school was identified for each high school and invited to participate. In total, 79% (134) of the selected schools participated. At Wave I, a total of 90,118 (76% of those eligible) students completed an in-school survey that assessed background, school and social life, health, and health-related behaviors. A sub-sample of 20,745 adolescents (80% of those eligible) completed an additional in-home interview. Adolescents who completed the in-home interviews were contacted to complete additional in-home interviews at Wave II (1996, $N = 14{,}738$), Wave III (2001–2002, $N = 15{,}197$) and Wave IV (2008–2009, $N = 15{,}701$). At each wave, Add Health collected an assortment of information, including sociodemographic and psychosocial characteristics, household structure, health behaviors, and risk behaviors. At Wave IV, researchers obtained biomarkers of cardiovascular health. Full study details have

Table 1
Descriptive statistics.

Variable	Father Support		Mother Support	
	Sexual minority (N = 445) M(*SD*)/ %(*N*)	Straight (N = 2722) M(*SD*)/%(*N*)	Sexual minority (N = 504) M(*SD*)/ %(*N*)	Straight (N = 3071) M(*SD*)/%(*N*)
Age	28.54(1.73)	28.92(1.78)	28.49(1.71)	28.94(1.78)
Sex				
Male	22.25(99)	52.65(1433)	21.83(110)	52.69(1618)
Female	77.75(346)	47.35(1289)	78.17(394)	47.31(1453)
Race				
White	80.90(360)	77.08(2098)	79.37(400)	74.89(2300)
Black or Other	19.10(85)	22.92(624)	20.63(104)	25.11(771)
Yearly Income				
Less than $39,999	36.18(161)	26.71(727)	38.89(196)	28.33(870)
$40,000 or higher	63.82(284)	73.29(1995)	61.11(308)	71.67(2201)
Education				
High school or less	15.73(70)	21.82(594)	17.06(86)	22.50(691)
Some college or more	84.27(375)	78.18(2128)	82.94(418)	77.50(2380)
BMI Classification				
Normal or underweight	67.42(300)	65.03(1770)	66.07(333)	64.96(1995)
Obese	32.58(145)	34.97(952)	33.93(171)	35.04(1076)
Physical Activity				
Less than 5 times a week	52.13(232)	56.50(1538)	51.59(260)	57.47(1765)
5 or more times a week	47.87(213)	43.50(1184)	48.41(244)	42.53(1306)
Depressive Symptoms	.80(.51)	.61(.44)	.81(.52)	.62(.44)
Subclinical Symptoms	.56(.81)	.40(.69)	.56(.80)	.40(.69)
Anti-Inflammatory Medication Use				
Yes	35.06(156)	27.85(758)	34.13(172)	28.30(869)
No	64.94(289)	72.15(1964)	65.87(332)	71.70(2202)
Smoke Cigarettes[1]				
Yes	48.09(214)	35.05(954)	52.78(266)	36.11(1109)
No	51.91(231)	64.95(1768)	47.22(238)	63.89(1962)
Ever Married				
Yes	38.43(171)	53.49(1456)	38.29(193)	52.43(2098)
No	61.57(274)	46.51(1266)	61.71(311)	31.68(973)
hsCRP[2]	2.66(2.52)	2.50(2.38)	2.76(2.53)	2.51(2.38)
Perceived Discrimination				
Never	25.84(115)	31.96(870)	25.20(127)	31.68(973)
Rarely	46.29(206)	46.00(1252)	46.83(236)	45.56(1399)
Sometimes	23.81(120)	18.74(510)	23.81(120)	19.21(590)
Often	4.17(17)	3.31(90)	4.17(21)	3.55(109)
Father Support	3.84(1.20)	4.14(1.08)	–	–
Mother Support	–	–	4.31(.98)	4.52(.81)

[1] Within the last 30 days; [2] High-sensitivity CRP.

been described elsewhere (http://www.cpc.unc.edu/projects/addhealth/design).

Data for the current study were obtained from Wave IV, when participants ranged in age from 24 to 33 years. To be included in the analyses, participants must have had all data for sociodemographics, sexual orientation, measures of father and/or mother support, and completed measures of cardiovascular health at Wave IV. A total of 3167 and 3575 participants met criteria for father and mother support, respectively. See Table 1 for demographic characteristics of the study samples.

2.2. Measures

2.2.1. Demographics

Respondents self-reported demographic characteristics at each wave. However, we used the most current measures (Wave IV) in the current analyses. Age was calculated as a continuous measure by subtracting their self-reported date of birth from the date of their Add Health interview. Race was ascertained via self-report by asking the participants if they identified as 1 = *White*, 2 = *Black*, or 3 = *Other*, which was collapsed into 0 = *White* vs 1 = *Other* for the present analyses. Participants self-reported total annual income from a range 12-categories from 1 = *Less than* $5000 to 12 = *$150,000 or more*.

2.2.2. Sexual orientation

Sexual orientation was assessed at Wave IV via self-report by asking respondents to choose which description best fits themselves. Response categories were: 1 = *100% Heterosexual*, 2 = *Mostly heterosexual but somewhat attracted to people of their own sex*, 3 = *Bisexual*, 4 = *Mostly homosexual but somewhat attracted to people of the opposite sex*, 5 =

100% Homosexual and 6 = *Not sexually attracted to either males or females*. Due to only a small percentage identifying as anything other than 100% heterosexual (14.6%, $N = 598$), we collapsed across categories to create a dichotomous 1 = *Heterosexual* and 2 = *Sexual minority* variable. Further, we dropped those who identified as asexual (category 6) in these analyses ($N = 26$).

2.2.3. Perceived discrimination

Perceived discrimination was measured by asking, "*In your day-to-day life, how often do you feel you have been treated with less respect or courtesy than other people.*" Response categories fell on a 3-point Likert scale from 0 = *Never*, 1 = *Rarely*, 2 = *Sometimes*, 3 = *Often*. Due to a small number of respondents reporting "often" (< 5% among each category; see Table 1), we dichotomized the discrimination variable to reflect 0 = *Never* and 1 = *Rarely, sometimes, or often*.

2.2.4. Perceived social support from one's father/father-figure and mother/mother-figure

To assess social support from one's father/father-figure, respondents were asked "*How close do you feel to your father figure?*" Respondents were also asked the same question about one's mother or mother-figure. Answers for both questions fell on a 5-point Likert scale ranging from 1 = *Not at all close* to 5 = *Very close*. For the current analyses, perceived social support from one's parental figures were entered into their respective models as continuous, with higher scores denoting greater perceived social support.

2.2.5. High-sensitivity C-reactive protein (hsCRP)

Blood spot samples were collected via finger prick and sent for laboratory analysis for CRP using a high-sensitivity immunoassay kit (mg/L). Trained research assistants collected blood spots on standardized filter paper using a sterile, one-use lancet. For the present analyses, we excluded individuals with high-sensitivity CRP levels greater than or equal to 10 because this is suggestive of infection or pathology (Yeh and Willerson, 2003). Consistent with past research, we log-transformed CRP values in order to account for the positive skew of the distribution, and the log-transformed values were treated as a continuous outcome variable (Hatzenbuehler et al., 2013; Manning and Mullahy, 2001).

2.2.6. Covariates

All models included controls known to affect CRP estimates, including age, sex, race, socioeconomic status, BMI, smoking status, marriage status, anti-inflammatory medication use, depressive symptoms, and physical activity. Using a similar approach to past research with Add Health (Hatzenbuehler et al., 2014), we dichotomized income and education variables into 1 = *$39,999 or less* and 2 = *$40,000 or greater* and 1 = *Less than high school* and 2 = *At least a high school diploma/GED* categories, respectively, in order to control for SES. BMI was entered as a dichotomous variable based on reported BMI classification as 0 = *Underweight or normal* and 1 = *Obese*. Due to the wording of the questions at Wave IV, marriage was entered as a dichotomous variable using 0 = *Never married* and 1 = *Ever married* and smoking status was entered as 0 = *No reported smoking within the last 30 days* and 1 = *Reported smoking within the last 30 days*. Depressive symptoms was ascertained using average scores for Center for Epidemiologic Studies Depression Scale (CES-D) at Wave IV (Andersen et al., 1994). Further, we controlled for whether or not an individual reported anti-inflammatory medication use at Wave IV. We controlled for physical activity similar to past research with a dichotomous variable denoting whether or not an individual engaged in at least 5 sessions of moderate to vigorous physical activity in the past week (Hatzenbuehler et al., 2014). Lastly, we controlled for subclinical symptoms of illness, infection, and injury due to their potential to affect CRP estimates by including a categorical count variable that signifies the number of symptoms that an individual had experienced within the last two weeks. Add Health researchers asked respondents a series of seven Yes/No questions regarding physical symptoms (e.g., "*Have you had a fever in the last two weeks?*") A 4-category symptom count variable was then created that ranged from 0 = *No symptoms* to 3 = *3 or more symptoms*, which was entered as a continuous variable.

2.3. Analytic strategy

We first conducted univariate and bivariate statistics for all study variables. We then performed main effects linear regression models with log-transformed CRP values as the outcome to determine the association between perceived parental social support (i.e., mother and father support), discrimination, and CRP among sexual minorities and heterosexuals, for a total of four main effects models. Consistent with past research, we stratified our analyses by sexual orientation rather than introducing a three-way interaction between parental support, sexual orientation, and discrimination because of the potential of the interaction tests to be statistically underpowered among sexual minorities due to the smaller sample size (Conron et al., 2010; Greenland, 1983). To determine if the association between perceived discrimination and CRP differed by level of parental support among sexual minorities and heterosexuals, we ran linear regression models separately for sexual minorities and heterosexuals with a perceived parental social support*discrimination for mother support and father support, for a total of four moderation models. Lastly, we ran post-hoc analyses to test for differences in regression parameters between sexual minorities and heterosexuals using the Wald test (Liao, 2004). All analyses were conducted using Stata v13 (StataCorp, 2013).

3. Results

3.1. Father support

3.1.1. Sexual minorities

Table 2 reports the results for the multivariable linear regression models heterosexuals examining how father support influences the association between perceived discrimination and CRP among sexual minorities and heterosexuals. Main effects indicated that neither perceived social support from one's father ($b = 0.02$, p = .64; Table 2, Model 1) nor perceived discrimination ($b = 0.08$, p = .48; Table 2, Model 1) were associated with CRP among sexual minorities. However, perceived father support significantly moderated the association between discrimination and CRP among sexual minorities when controlling for all relevant covariates ($b = -0.21$, p = .02; Table 2, Model 2) suggesting the presence of a cross-over interaction (Szklo and Nieto, 2014). The interaction revealed that among those with lower father support, those who experienced discrimination had higher CRP as compared to those who did not experience discrimination. However, among those with higher father support, those who experienced discrimination had lower CRP than those who did not experience discrimination (see Fig. 1).

3.1.2. Heterosexuals

Among heterosexuals, main effects indicated that perceived father

Table 2
Linear Regression Models for Log-Transformed CRP and Father Support Among Sexual Minorities and Heterosexuals.

	Sexual Minority (N = 445)				Heterosexual (N = 2722)			
	Model 1. Main Effects		Model 2. Interaction		Model 3. Main Effects		Model 4. Interaction	
	b(SE)	*p*	*b*(SE)	*p*	*b*(SE)	*p*	*b*(SE)	*p*
Intercept	−.67(.86)	.44	−1.27(.89)	.15	−.53(.34)	.11	−.40(.36)	.27
Age	.03(.03)	.33	.03(.03)	.34	.01(.01)	.47	.01(.01)	.50
Sex								
Male	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
Female	.24(.11)*	.04	.23(.11)*	.05	.38(.04)***	< .0001	.38(.04)***	< .0001
Race								
White	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
Black or Other	−.08(12)	.50	−.07(.12)	.54	−.09(.05)*	.05	−.10(.05)*	.04
Income								
$39,999 or less	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
$40,000 or more	.24(.10)*	.02	.27(.10)*	.01	.01(.05)	.79	.01(.05)	.80
Education								
Less than high school	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
High school or more	−.46(.13)**	.001	−.46(.13)**	.001	−.07(.05)	.15	−.07(.05)	.15
BMI								
Normal or underweight	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
Obese	.91(.10)***	< .0001	.89(.10)***	< .0001	.82(.04)***	< .0001	.82(.04)***	< .0001
Physical Activity								
Less than 5 times	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
5 times or more	−.25(.10)*	.01	−.27(.10)**	.006	−.06(.04)	.11	−.06(.04)	.11
Depressive Symptoms	−.09(.10)	.35	−.09(.10)	.33	−.04(.04)	.37	−.04(.05)	.37
Subclinical Symptoms	.24(.06)***	< .0001	.24(.06)***	< .0001	.11(.03)***	< .0001	.11(.03)***	< .0001
Anti-Inflammatory Medication Use								
Yes	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
No	.03(.10)	.79	.04(.10)	.71	.05(.04)	.22	.05(.04)	.22
Smoking Status								
No	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
Yes	−.06(.10)	.51	−.06(.10)	.55	.00(.04)	.996	−.00(.04)	.997
Ever Married								
No	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
Yes	.14(.11)	.19	.14(.11)	.19	.05(.04)	.20	.05(.04)	.21
Perceived Discrimination (PD)								
No	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
Yes	.08(.11)	.48	.90(.37)*	.02	.02(.04)	.58	−.16(.16)	.33
Perceived Father Support (PFS)	.02(.04)	.64	.17(.08)*	.03	.06(.02)**	.001	.03(.03)	.29
PD*PFS	–	–	−.21(.09)*	.02	–	–	.04(.04)	.25

Note: Ref. = reference category.
* p < .05.
** p < .01.
*** p < .0001.

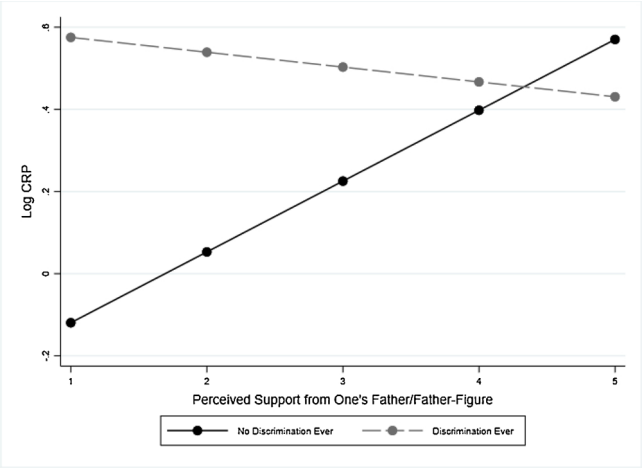

Fig. 1. Father support, discrimination, and CRP among sexual minorities.

support was positively associated with CRP (b = 0.06, p = .02; Table 2, Model 3) such that those who perceived more social support from one's father or father figure had higher CRP as compared to those who report less perceived father social support. However, father support did not moderate the association between perceived discrimination and CRP among heterosexuals (b = .04, p = .25); Table 2, Model 4).

3.1.3. *Differences between sexual minorities and heterosexuals*

To test if the size of the father support*discrimination coefficient varied between sexual minorities and heterosexuals, we ran a post-hoc analysis using the Wald test with the null hypothesis that the coefficients for sexual minorities and heterosexuals are equal. The Wald test revealed that the size of the interaction coefficient significantly differed between sexual minorities and heterosexuals ($\chi^2(1) = 6.40$, p = .01).

3.2. *Mother support*

Although the moderation models were significant for both sexual minorities ($F_{(15, 488)} = 9.50$, $p < .0001$) and heterosexuals ($F_{(15, 3055)} = 40.70$, $p < .0001$), results indicated that the mother support did not significantly moderate the association between discrimination and CRP among either group. Because the interaction term was not significant among either sexual minorities or heterosexuals, no further analyses were conducted. See Table 3 for model results for mother support.

Table 3
Linear Regression Models for Log-Transformed CRP and Mother Support Among Sexual Minorities and Heterosexuals.

	Sexual Minority (N = 504)				Heterosexual (N = 3071)			
	Model 1. Main Effects		Model 2. Interaction		Model 3. Main Effects		Model 4. Interaction	
	b(SE)	*p*	*b*(SE)	*p*	*b*(SE)	*p*	*b*(SE)	*p*
Intercept	−.61(.84)	.47	−.93(.91)	.31	−.21(.33)	.52	−.09(.37)	.81
Age	.04(.03)	.13	.04(.03)	.15	−.00(.01)	.998	−.00(.01)	.99
Sex								
Male	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
Female	.21(.11)	.06	.22(.11)	.05	.33(.04)***	< .0001	.33(.04)***	< .0001
Race								
White	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
Black or Other	−.01(.11)	.90	−.02(.11)	.87	−.08(.04)	.08	−.08(.04)	.08
Income								
$39,999 or less	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
$40,000 or more	.10(.10)	.30	.09(.10)	.33	.02(.04)	.64	.02(.04)	.64
Education								
Less than high school	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
High school or more	−.35(.12)**	.004	−.35(.12)**	.005	−.06(.04)	.21	−.05(.05)	.21
BMI								
Normal or underweight	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
Obese	.88(.10)***	< .0001	.88(.10)***	< .0001	.82(.04)***	< .0001	.82(.04)***	< .0001
Physical Activity								
Less than 5 times	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
5 times or more	−.24(.10)**	.007	−.25(.09)**	.008	−.08(.04)*	.03	−.08(.04)*	.03
Depressive Symptoms	−.05(.09)	.58	−.05(10)	.61	−.04(.04)	.36	−.04(.04)	.36
Subclinical Symptoms	.22(.06)***	< .0001	.22(.06)***	< .0001	.12(.03)***	< .0001	.12(.03)***	< .0001
Anti-Inflammatory Medication Use								
Yes	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
No	.01(.10)	.92	.01(.10)	.92	.06(.04)	.18	.06(.04)	.18
Smoking Status								
No	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
Yes	−.11(.10)	.22	−.11(.09)	.22	.00(.04)	.994	.00(.04)	.98
Ever Married								
No	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
Yes	.15(.10)	.14	.15(.10)	.13	.08(.04)*	.03	.08(.04)*	.03
Perceived Discrimination (PD)								
No	*Ref.*	–	*Ref.*	–	*Ref.*	–	*Ref.*	–
Yes	.08(.11)	.46	.52(.53)	.33	.00(.04)	.91	−.17(.23)	.47
Perceived Mother Support (PMS)	−.07(.05)	.14	.01(.10)	.93	.04(.02)	.08	.01(.04)	.74
PD*PMS	–	–	−.10(.12)	.40	–	–	.04(.04)	.45

Note: Ref. = reference category.
* p < .05.
** p < .01.
*** p < .0001.

4. Discussion

The main aims of this study were to understand; a) if father or mother support influenced the association between discrimination and CRP separately for heterosexual and sexual minorities, and b) if there was a statistically significant difference in the effect of father and/or mother support on the association between discrimination and CRP among heterosexual and sexual minorities. We hypothesized that both sexual minorities and heterosexuals who experience discrimination would have lower CRP if they reported high social support from one's father/father-figure or mother/mother-figure, and that this association would be more pronounced among sexual minorities as compared to heterosexuals. The results of our study partially supported the study hypotheses. First, we found that father support moderated the association between perceived and CRP among sexual minorities such that those who perceived discrimination and who reported lower levels of father support had higher CRP as compared to those who perceived discrimination and who reported higher levels of father support (Fig. 1). Second, we found that father support is associated with CRP levels among heterosexuals, though it did not moderate the association between perceived discrimination and CRP. We found no evidence to support our hypothesis that mother support moderates the association between perceived discrimination and CRP among either sexual minorities or heterosexuals.

Although there was no main effect of father support or perceived discrimination on CRP among sexual minorities or heterosexuals, we did find evidence of a cross-over interaction effect of father support on the influence of discrimination exposure on CRP among sexual minorities, and that this association was stronger among sexual minorities as compared to heterosexuals. Theoretical and empirical literature supports our finding that lower perceived father support may interact with discrimination to negatively influence CRP levels among sexual minorities as compared to heterosexuals. This is because prolonged exposure to stress, particularly in the form of discrimination, can lead to an over activation of the biological stress system (Hatzenbuehler, 2009; Hatzenbuehler et al., 2013). Normally, the hypothalamic-pituitary-adrenal (HPA) axis responds to a stressful event by releasing hormones such as cortisol (McEwen, 1998). However, prolonged exposure to stress may lead to the continuous activation of the HPA axis resulting in the chronic secretion of stress hormones (McEwen, 1998). This, in turn, can negatively influence immune system functioning (Segerstrom and Miller, 2004), leading to the release of inflammatory biomarkers such as CRP and place individuals at a greater risk for poor cardiovascular health (Kaptoge et al., 2010). A plethora of studies document the association between prolonged stress exposure and CRP (Everett et al., 2014; Seeman et al., 2014; Taylor et al., 2006). For instance, several

longitudinal studies found that those with prolonged exposure to stress (e.g., low socioeconomic status, exposure to an abusive family member; Taylor et al., 2006) or discrimination (Cunningham et al., 2012; Lewis et al., 2010) were more likely to have increased CRP levels as compared to those who did not experience early stress or discrimination. Thus, our finding that sexual minorities who have lower perceived father support and who experience discrimination have higher CRP as compared to those with moderately higher levels of father support provides further evidence of the physiological effects of prolonged stress exposure among sexual minorities.

Although the wider research literature documents a positive association between discrimination and cardiovascular risk, it is evident that both sexual minority and heterosexual individuals possess mechanisms through which they are able to circumvent the ill effects of stress exposure on health. Much research exists in support of the buffering hypothesis. Individuals who report more social support have better overall well-being and physical health outcomes as compared to individuals who report less social support, a finding that has been found among both sexual minorities (Burton et al., 2014; Detrie and Lease, 2007; Rothman et al., 2012) and heterosexuals (Kawachi and Berkman, 2000; Uchino, 2009). It may be that social support from one's father or father-figure may act as either a buffer or an additional source of stress among sexual minorities. On one hand, positive social support from one's father or father-figure may serve as a protective base through which sexual minority individuals can mitigate the harmful experiences related to discrimination (Bouris et al., 2010; D'Augelli et al., 2010). On the other, poor social support from one's father or father-figure may lead to exacerbated stress and a poorer ability to shield against harmful experiences related to discrimination (D'Augelli et al., 2010). Our findings add to this body of research by suggesting that the protective features of social support from one's father or father-figure may differ between sexual minorities and heterosexuals.

Attachment theory may also be a useful paradigm through which to view the study results. According to attachment theory (Bowlby, 1969), individuals form secure or insecure attachments to caregivers early in life that influence social relationships throughout the life-course. Moreover, attachment is also posited to influence social relationships in adulthood (Mikulincer and Shaver, 2007). More specifically, insecure attachment may decrease one's ability to form and maintain protective social relationships with attachment figures such as fathers and peers throughout the life-course. This, in turn, may lead to increased physiological stress and place individuals at a greater likelihood of experiencing poor health later in life. Indeed, research documents that insecure attachment is associated with various inflammatory biomarkers (Gouin et al., 2009). Moreover, the IASMS suggests that sexual minorities may experience an increased likelihood of developing insecure attachment as a consequence of rejection based on sexual minority identity (Cook and Calebs, 2016). Although the current study did not examine rejection experiences based on one's sexual orientation, our results provide preliminary evidence for the IASMS (Cook and Calebs, 2016) in that the influence of father support on the association between discrimination and CRP was stronger among sexual minorities as compared to heterosexuals. Further research should focus on specifying the complex associations between specific aspects of attachment-related processes (e.g., paternal social support) and cardiovascular health among sexual minority and heterosexual populations.

Although the association between perceived discrimination and CRP did not differ by level of perceived mother support among either sexual minorities or heterosexuals, previous research may aid in explaining these findings. For instance, in a study of 2722 British adolescents ages 14–18 years Flouri and Buchanan (2003) found that as compared to mother support, father support played a stronger role in the well-being and happiness of adolescents. Moreover, a study of 99 emerging adult female college students found that those who reported higher father involvement had higher self-esteem and life satisfaction as compared to those who reported lower father involvement (Allgood et al., 2012). Thus, it may be the case that father support plays an particular role in how individuals perceive and process stressors throughout the life-course. Another potential explanation for the null findings among mother support may be that the effect of mother support is suppressed due to its association with another factor or set of factors. For instance, research documents that individuals who report high levels of support from ones mother/mother-figure have better peer ties and familial relationships throughout the life-course, and thus it may be difficult to parse out the effects of mother support without considering other forms of social support (Liu, 2006). Indeed, research documents the importance of peer relationships on mental health outcomes during young adulthood (Lee and Goldstein, 2016). Therefore, peer social support may be more salient than mother support, thus masking the impact of mother support on the association between discrimination and CRP in our study. Future research should focus on parsing out these differing forms of social support (e.g., mother support, peer support) and their associations, or lack thereof, with discrimination and CRP among sexual minorities and heterosexuals.

In summary, this study provides evidence that perceived social support by one's father or father-figure may act differentially across sexual minority and heterosexual populations to mitigate early cardiovascular risk. Although research documents that sexual minority youth tend to report lower levels of family connectedness and/or closeness than their heterosexual counterparts (Eisenberg and Resnick, 2006), very few studies have examined perceived familial closeness and/or support differentially influence cardiovascular risk between sexual minorities versus heterosexuals. Pearson and Wilkinson (2013) found that aspects of familial relationships, including perceived closeness, were not as protective against poor mental health and risky substance use behavior among same-sex attracted youth versus heterosexual youth. Another study found that aspects of minority stress (i.e., internalized homophobia and rejection sensitivity) were associated with more depressive symptoms only among sexual minorities with less accepting parents as compared to sexual minorities with more accepting parents (Feinstein et al., 2014). This same study, however, also found that parental support was not a significant moderator of the association between minority stress and depressive symptoms among sexual minorities (Feinstein et al., 2014). Further research should explore how different types of father support (e.g., perceived closeness, financial support, etc.) influences cardiovascular risk among sexual minority versus heterosexual populations.

5. Limitations

There are several limitations to the current study. First, there was a small sample of sexual minority respondents who fit the study criteria. Thus, we had to collapse sexual orientation categories that likely warrant exploration on their own (e.g., lesbian vs gay vs bisexual). For instance, one study found that perceived family support did not differ among bisexual young adults versus heterosexual young adults (Needham and Austin, 2010); however, bisexual women reported significantly less familial support as compared to heterosexual women. Nevertheless, this is one of the first studies to use a heterogeneous sample in order to examine the specific roles that father and mother support plays in the association between perceived discrimination and disparities in cardiovascular risk between sexual minority and heterosexual young adults. Future research should be devoted to further unpacking the role that different types of family support plays in buffering the association between discrimination exposure and cardiovascular health among diverse sexual minority populations. Second, we were unable to determine the cause and frequency of perceived discrimination experienced by the respondents (e.g., sexual orientation-related or racial/ethnic-related) and we were limited by the single measure of discrimination. Thus, our results may not accurately represent the experience of perceived discrimination on a day-to-day basis. Nevertheless, this single measure has been used in previous research

examining the effects of perceived discrimination on health outcomes utilizing data from Wave IV of Add Health (e.g., Everett et al., 2016). Future research should use more comprehensive measures of discrimination when examining how parental social support may influence the association between discrimination and CRP. Moreover, the measure for perceived support from one's father or father-figure only contained a single measure and thus may not wholly represent the construct of father support. However, past research suggests that perceived closeness is a core aspect of supportive social relationships and that it is highly correlated with social support and thus we felt that it was an appropriate proxy for social support (Gottlieb and Bergen, 2010). Lastly, we only examined one biomarker (i.e., CRP) although other anthropometric measures (e.g., blood pressure, interleukin-6) may also be associated with cardiovascular health. However, a recent review found that studies using composite cardiovascular health scores may mask cardiovascular health differences among sexual minorities and heterosexuals (Caceres et al., 2017). In spite of these limitations, the current study is among one of the first to examine the influence of fathers and father-figures on physical health outcomes of sexual minorities and heterosexuals. Future research should continue to examine how multiple forms of discrimination influence cardiovascular outcomes between sexual minority and heterosexual populations.

6. Conclusion

The current study highlights the need for future research examining how different forms of social support may influence the ways in which discrimination affects indices of cardiovascular health among sexual minorities and heterosexuals. Our findings add to the emerging literature relating perceived social support from one's father to physical health outcomes between sexual minorities and heterosexuals. To our knowledge, we are among the first to examine how perceived support from one's father or father-figure influences the association between perceived discrimination exposure and cardiovascular health among sexual minorities versus heterosexuals. This study provides preliminary evidence of the potentially differential role that father support may play in cardiovascular health outcomes between sexual minority and heterosexual populations, and also notes the potential differential role that stressors such as discrimination play in the health of sexual minorities and heterosexuals. Moreover, our findings have particular relevance for professionals aiming to work with fathers who may reject their children because of their minority sexual identity by signifying the importance of nurturing the father-child relationship among sexual minority youth in order to reduce the negative effects of minority stress exposure on cardiovascular health outcomes across the life-course. Future research should be devoted to further unpacking the differential influence of father support in buffering the association between discrimination and cardiovascular risk among sexual minority and heterosexual populations.

Declaration of Competing Interest

The authors declare no conflicts of interest.

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